

Study reveals unique survival strategies adopted by fish in the world's warmest waters

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Scolopsis ghanam captured by Rebekka Pentti for NYU Abu Dhabi. Credit: Rebekka Pentti for NYU Abu Dhabi

A team of researchers have identified unexpected ways coral reef fish

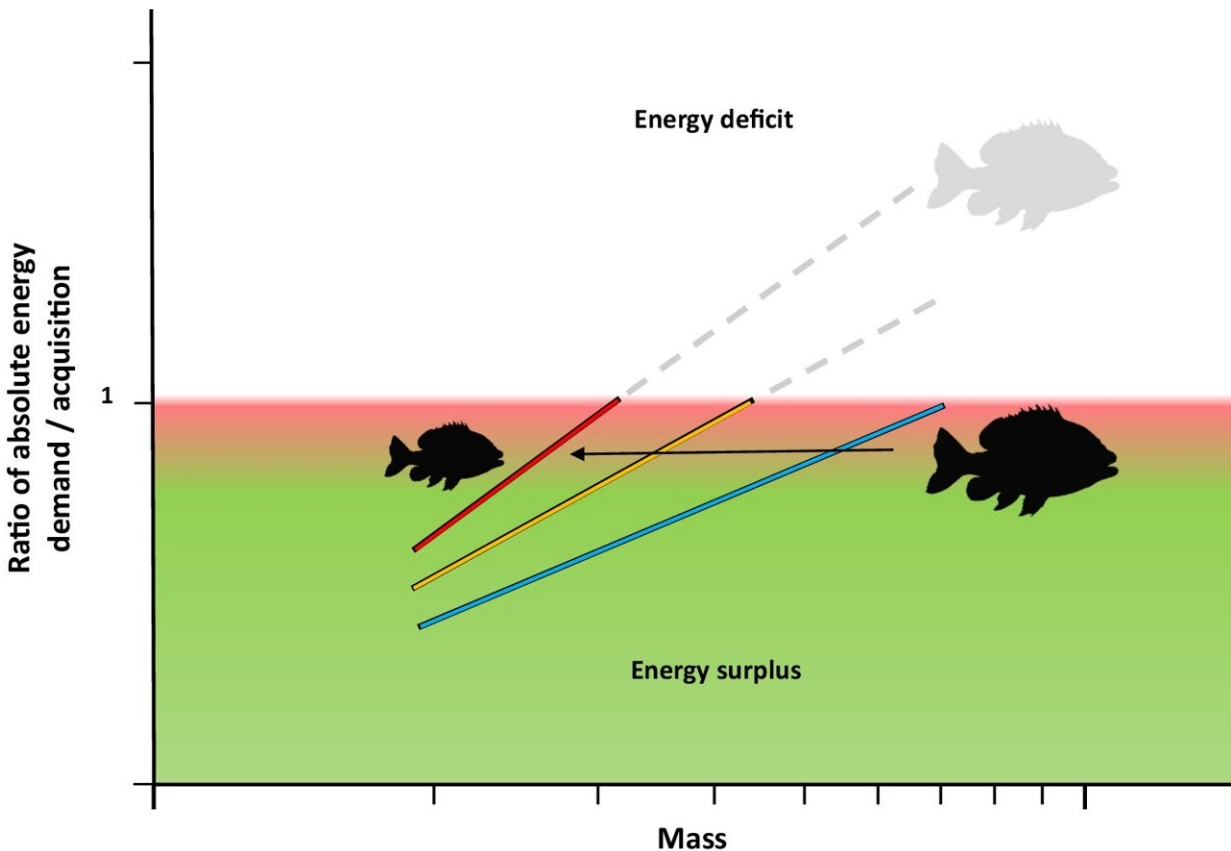
living in the warmest waters on Earth, in the Arabian Gulf, have adapted to survive extreme temperatures.

Led by Co-Principal Investigator at The Mubadala Arabian Center for Climate and Environmental Sciences (ACCESS) at NYU Abu Dhabi John Burt and Associate Research Professor, Hawaii Institute of Marine Biology Jacob Johansen, the team discovered adaptations in both metabolism and swimming abilities that help fish survive the conditions of the Arabian Gulf.

Surprisingly, these fish did not follow leading theoretical predictions, which expected that the maximum size of fishes should be reduced due to limitations in metabolic oxygen-supply. Instead, these fishes demonstrated a capacity to maintain efficient oxygen supply to fuel performance even at elevated temperatures.

The warming of our oceans is anticipated to drastically affect [marine life](#) and the fishing industry, potentially upsetting entire ecosystems and economic structures reliant on these habitats. Current scientific models predict that by 2050, coral reef fishes could shrink by 14–39% in size due to increasing temperatures under [climate change](#).

The study's findings challenge the prevailing view that oxygen supply limitations in larger fishes are the main reason for smaller fish in warmer waters—the so-called "shrinking of fishes phenomenon." The species observed did not follow this pattern, suggesting that other factors are also at play.



Scolopsis ghanam captured by Rebekka Pentti for NYU Abu Dhabi. Credit: Rebekka Pentti for NYU Abu Dhabi

The study proposes a new theory that the decrease in fish sizes and their survival in increasingly warm oceans might be more closely related to an imbalance between how much energy [fish species](#) can obtain and how much they need to sustain themselves.

In the paper titled "[Impacts of ocean warming on fish size reductions on the world's hottest coral reefs](#)" published in the journal *Nature Communications*, the researchers compared two species of fishes, *Lutjanus ehrenbergii* and *Scolopsis ghanam*, surviving under the elevated temperatures within the Arabian Gulf to those of similar age living in the

cooler, more benign conditions in the nearby Gulf of Oman.

Specifically, the researchers set out to determine what qualities reef fishes in the Arabian Gulf have that enable them to survive there, where typical summer water temperatures are comparable to worst-case ocean warming projections for many tropical coral reefs globally by 2100.



Lutjanus ehrenbergii captured by Rebekka Pentti for NYU Abu Dhabi. Credit: Rebekka Pentti for NYU Abu Dhabi

"The hottest coral reefs in the world are an ideal natural laboratory to explore the future impact of rising water temperatures on fishes. Our findings indicate that some fish species are more resilient to climate

change than previously understood and help explain why smaller individuals are evolutionarily favored at high temperatures," said Burt.

"This has significant implications for our understanding of the future of marine biodiversity in a continuously warming world."

More information: Jacob L. Johansen et al, Impacts of ocean warming on fish size reductions on the world's hottest coral reefs, *Nature Communications* (2024). [DOI: 10.1038/s41467-024-49459-8](https://doi.org/10.1038/s41467-024-49459-8)

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